INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification [4]: B27N 3/12 — A1

(11) International Publication Number: WO 87/ 03839

(43) International Publication Date: 2 July 1987 (02.07.87)

(21) International Application Number: PCT/SE86/00522

(22) International Filing Date: 13 November 1986 (13.11.86)

(31) Priority Application Number: 8506018-4

(32) Priority Date: 19 December 1985 (19.12.85)

(33) Priority Country: SE

(71) Applicant *(for all designated States except US)*: SUNDS DEFIBRATOR AKTIEBOLAG [SE/SE]; S-851 94 Sundsvall (SE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: GRAN, K., Gunnar, M. [SE/SE]; Matrosbacken 28, S-117 47 Stockholm (SE).

(74) Agent: ILLUM, Leif-Otto; Svenska Cellulosa Aktiebolaget SCA, Kungsgatan 33, S-111 56 Stockholm (SE).

(81) Designated States: AT (European patent), AU, DE (European patent), FI, FR (European patent), GB (European patent), JP, NO, SE (European patent), US.

Published
With international search report.

(54) Title: MANUFACTURE OF FIBREBOARD

(57) Abstract

Fiberboards are manufactured by defibration of fibre material, admixture of binding agent, drying of the fibres and forming of a fibre mat, which is pressed to boards. The fibre mat is formed of two outer layers and one intermediate central layer. The fibres intended for the central layer are caused at the drying to assume a very low moisture content, suitably 2-8%, in relation to the fibres intended for the outer layers, which preferably are given a moisture content of 15-30%.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**FR**	France	**ML**	Mali
AU	Australia	**GA**	Gabon	**MR**	Mauritania
BB	Barbados	**GB**	United Kingdom	**MW**	Malawi
BE	Belgium	**HU**	Hungary	**NL**	Netherlands
BG	Bulgaria	**IT**	Italy	**NO**	Norway
BJ	Benin	**JP**	Japan	**RO**	Romania
BR	Brazil	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SN**	Senegal
CH	Switzerland	**LI**	Liechtenstein	**SU**	Soviet Union
CM	Cameroon	**LK**	Sri Lanka	**TD**	Chad
DE	Germany, Federal Republic of	**LU**	Luxembourg	**TG**	Togo
DK	Denmark	**MC**	Monaco	**US**	United States of America
FI	Finland	**MG**	Madagascar		

Manufacture of fibreboard

This invention relates to the manufacture of fibreboard according to the dry process where the fibre material, for example lignocellulose -containing material, is defibrated, mixed with binding agent, dried and formed to a fibre mat, which is hot pressed. The defibration usually is carried out at overpressure in a defibering apparatus. Thereafter binding agent is admixed to the defibrated material, which admixing preferably can be made in connection with the blowing of the fibres out of the defibering apparatus to a fibre dryer.

At the manufacture of fibreboard according to this method, especially at the manufacture of so-called MDF-board (MDF = Medium Density Fibreboard), fibres with resin added usually are dried in a suitable dryer, normally a tube-type dryer, to a moisture ratio in the range 10-15%. The drying hereby proceeds very rapidly. The entire drying time is of the magnitude 5 seconds. The dried fibres are then intermediately stored in a buffer bin and thereafter formed in a forming station to a substantially homogeneous mat.This mat is pre-pressed in cold state in a continuous pre-press and possibly additionally pre-pressed in a discontinuous platen pre-press, after the continuous mat had been divided into adequately long pieces to fit into the subsequent hot press.

In certain cases - especially in factories with high production capacity - the fibre preparation, inclusive of defibrating, adding resin, drying and intermediate storage, is carried out in two or more production lines, and the fibre mat is formed in forming stations with at least three forming units, whereby a non-homogeneous, but symmetrical mat can be built up. The mat in principle can consist of two outer layers with one (or several) intermediate layers. The

fibres in the outer and, respectively, intermediate layers can be slightly different in respect of, for example, raw material comprised therein, fibre coarseness, resin amount and resin type. In some cases resin can be added to the fibres for the intermediate layer after the drying.

The fibre mat is formed in a forming station, to which the fibres are transported by air from the buffer bin. The transporting air entirely or partially will be sucked through the fibre mat formed in the forming station when the mat is precipitated on a wire cloth with suction boxes arranged therebeneath. The fibre mat formed normally will have a relatively uniform moisture ratio from the upper surface to the lower one.

At the manufacture of particle board, chip mats usually are formed in three layers, and the chips for the two outer layers are given a higher moisture ratio than the chips for the intermediate layer. This is possible as the chip mat is formed on a conveyor belt of reinforced plastic or steel without air passage therethrough. This non-homogeneous moisture distribution has a positive effect at the subsequent hot pressing due to the so-called steam jet effect. At fibre mats it is difficult to bring about a corresponding non-homogeneous moisture distribution. Many tests have been made to bring about by different methods outer layers having a higher moisture ratio than the intermediate layer. It is, for example, relatively easy to increase the moisture ratio in the upper outer layer by spraying water on the upper surface of the mat. Attempts have also been made to spray water on the lower surface of the mat, but these attempts usually failed due to the difficulty of keeping the moist lower surface intact when the mat and, respectively, the sheet is transported to and into the hot press.

At the pressing of fibre sheets with homogeneous moisture ratio it was found, that the outer layers become pre-cured, as it is called. This pre-curing expresses itself in that the outermost parts of the outer layers become dried-out,

and that the resin there can cure before a sufficiently high pressure was obtained at the hot pressing. The very outermost layers of the boards thereby assume a loose structure and, therefore, must be ground off. Under laboratory conditions it is easy to moist both the upper and the lower surface of a fibre sheet. Such experiments have shown that a possible moistening of the sheet surfaces results in decreasing the pre-curing and shortening the pressing time.

The homogeneous moisture distribution in the fibre sheet, besides, seems to have another effect on the completed boards. At hot pressing without using high-frequency heating (HF), the moisture in the outer layers of the sheet is driven inward to the centre of the sheet. Subsequent to the hot pressing, the boards usually are stored for some days in order to render possible balancing of the moisture in the boards between the outer and intermediate layers. It was now found that the moisture not even at storage during a very long time is balanced completely. The outer layers, which were dried out at the hot pressing, maintain a slightly lower moisture ratio than the central layer, which in its turn implies that stresses remain in the board even after a long storage time.

It was found that this permanent difference in moisture content is less pronounced when the outer layers at the hot pressing had been more moist than the central layer. It would, therefore, be of importance to be able to form and press sheets with a non-homogeneous moisture ratio distribution, so that the outer layers are more moist than the central layers when the sheet is introduced into the hot press. This, however, is difficult as reported above.

The present invention provides a method to overcome the aforesaid problem. The fibre mat, thus, is formed of two outer layers and one (or more) intermediate central layers, and the fibres intended for the central layer are caused at the drying to assume a very low moisture ratio, suitably

2-8%, in relation to the fibres intended for the outer layers. The lastmentioned fibres preferably are given a moisture ratio of 15-30%.

In factories with at least two fibre preparation lines, this involves no difficulty. It is there easy to dry in one line fibres to a relatively high moisture ratio and in a second line to dry fibres to a low moisture ratio.

In factories with only one fibre preparation line, according to the invention the problem can be solved by after-drying the fibre to be used for the central layer. The entire fibre amount is dried to a high moisture ratio, for example 25%, intended for the outer layer, whereafter about half the total fibre amount - intended for the central layer - is after-dried in a separate dryer, which must not be much greater than the pipe normally used for transporting central layer fibres from the buffer bin to the forming station. This tubular dryer intended for after-drying can be equipped with a cyclone for separating fibres from the transport drying air, but this must not necessarily be the case. Rough estimates have shown that the total heat requirement for the drying is less than or about equal to what is required at conventional drying of fibres for forming a fibre mat with homogeneous moisture ratio. The forming of the fibre mat is carried out in the normal way, but one prerequisite is that the forming station is equipped with at least three forming units (forming heads).

The advantages of the method according to the invention can be summarized as follows:

- Slightly less drying energy requirement
- Reduced pre-curing of the outer layers of the boards by a higher moisture ratio in the outer layers at the hot pressing
- Shorter pressing time due to improved heat transfer because of the difference in moisture ratio between outer and central layers (steam jet effect)

- More uniform balance moisture ratio in the different layers of the completed board due to the fact, that the central layer at the beginning of the hot pressing had a very low moisture ratio and the outer layer had a very high one
- Improved dimension stability due to said more uniform balance moisture ratio
- The hot press usually being the bottle-neck in the factory, the production capacity of the factory is higher due to the shorter pressing times.

Especially when the fibres for the central layer are after-dried, the fibres can come to the forming station at a higher temperature, 40-60°C compared to normally 25-35°C. This implies, that less thermal energy is required for heating the central layer than what normally is required, which also contributes to shortening the pressing time and reducing the heat requirement at the hot pressing.

When the forming proceeds slowly, there can be a certain tendency for balancing moisture and temperature in the different layers of the fibre mat. This tendency can be counteracted in that the different layers are formed separately and then combined first after the sucking-through of air has ceased, either continuously or by stacking in a way known per se.

The invention, of course, is not restricted to the embodiments described above, but can be varied within the scope of the invention.

Claims

1. A method of manufacturing fibreboard according to the dry process, comprising defibration of fibre material at overpressure in steam atmosphere in a defibering apparatus, admixing of binding agent to the defibrated material, forming of a fibre mat and hot pressing the same, c h a r a c t e r i z e d i n that the fibre mat is formed of two outer layers with a moisture ratio of 15-30% and at least one intermediate central layer with a moisture ratio of 2-8%, that all fibres first are dried to the higher moisture ratio intended for the outer layers and thereafter are divided into three or more partial flows, and that the fibres to form the central layer are passed through an after-drying for assuming the desired lower moisture ratio in relation to the fibres for the outer layers.

2. A method as defined in claim 1, c h a r a c t e r i z e d i n that the outer layers and, respectively, central layer are formed separately and thereafter combined to a fibre mat, which in respect of the moisture content is non-homogeneous, for example by stacking or in some other way.

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00522

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC [4]

B 27 N 3/12

II. FIELDS SEARCHED

Classification System	Minimum Documentation Searched [7] Classification Symbols
IPC	B 27 N 3/00, /02, /04, /08, /10, /12, /14; B 29 J 5/00, /04; B 32 B 21/00, /02
US Cl	156: 62.2, 62.4, 62.6, 62.8; 425: 80, 81, 82, 83

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	WO, A1, 83/04387 (SUNDS DEFIBRATOR AB) 22 December 1983 & SE, 8203516 DE, 3390039 CA, 1195071 SE, 442724	1,2
Y	Derwent's abstract No 45317 B/24, SU 619355	1,2
A	Paperchem's abstract No43-00462, Derevoobrabat Prom 20 No 10: 3-4 (Oct, 1971) (Russ)	1
A	Paperchem's abstract No 38-00254, Khim Pererabotka i Zashchita Drevesiny, Riga, Akad Nauk Latv SSR, 1964:213-23 (Russ)	1

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1987-02-04	1987 -02- 12
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Olov Jensén

Form PCT/ISA/210 (second sheet) (January 1985)

MJ